AD NUMBER
AD033343
CLASSIFICATION CHANGES
TO: **unclassified**
FROM: **restricted**
LIMITATION CHANGES
TO: **Approved for public release; distribution is unlimited.**
FROM: **Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 17 SEP 1953. Other requests shall be referred to Defense Threat Reduction Agency, Fort Belvoir, VA 22060.**
AUTHORITY
E.O. 10501, 5 Nov 1953; DNA ltr, 24 May 1974

[redacted]

Bendix-Pacific

11

DIM-27
AFSWP-227

GENERAL EQUIPMENT DESCRIPTION

PROJECT 1.3 CONTRACTS AF 19(122)-459 AND AF 19(604)-605

Bendix Aviation Corporation

Pacific Division

NORTH HOLLYWOOD, CALIF.

[redacted]

17 September 1953

[redacted]

DLM-27
AFSWP-227

Copy No. 11

GENERAL EQUIPMENT DESCRIPTION

PROJECT 1.3 CONTRACTS AF 19(122)-459 AND AF 19(604)-605

Contract Nos. AF 19(604)-605
AF 19(122)-459

PACIFIC DIVISION
Bendix Aviation Corporation
North Hollywood, California

Prepared by _____
C. W. Thomas

Approved by _____
C. L. Wetzel

Approved by _____
R. M. Combes
Chief Engineer
Development Laboratories

[redacted]

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

GENERAL EQUIPMENT DESCRIPTION
PROJECT 1.3 CONTRACTS AF 19(122)-459 AND AF 19(604)-605

SECTION I

INTRODUCTION

Under contract to the Air Force Cambridge Research Center, Bendix Aviation Corporation Pacific Division designed and fabricated telemetering equipments consisting of a number of airborne transmitting units and several receiving and recording ground stations. In a series of tests the equipments were used for measurements of the horizontal and vertical pressure distributions and of the rate of change of pressures and of certain temperatures during and immediately after the detonation of thermo-nuclear devices. These data are for use in continuing the studies of propagation of shock waves originating from such detonations. Arrays of telemetering transmitting units were deployed in prescribed patterns at a number of discreet altitudes and distances from the blast center. Although this telemetering equipment was designed to meet a specific requirement, many features were incorporated into the design which permit modification to meet a variety of requirements. This is particularly true of the receiving station installations.

Certain of the airborne equipments and all of the ground receiving equipments remain in good operating condition although the projects for which they were built have been concluded. The purpose of this report is to describe briefly the physical and electrical features of both the airborne and ground equipment and their adaptability for use on other projects.

Basically the airborne telemeter consisted of a crystal controlled RF transmitter, three subcarrier oscillators and three variable reluctance pickups. All of the airborne telemeters are identical except for the carrier frequency. The RF transmitters operated in the 235.5 to 259.25 mc band. Subcarrier frequencies employed were 7.35 kc, 10.5 kc and 14.5 kc. Two measurements of peak overpressure and an ambient altitude measurement were the prime information obtained. Measurements of canister release time and large and small chute opening times were obtained by the use of an incremental frequency shift system. A specially designed sequence timer was used to control parachute deployment.

The basic telemetering receiving station designed for use in conjunction with the airborne telemeters above consisted principally of an FM receiver, amplifiers, subcarrier bandpass filters, discriminators, low pass output filters and a recording oscillograph.

Because a prime operational requirement necessitated the use of as many as twenty-two airborne telemetering sets simultaneously, twenty-two receiving stations were required to receive and record the transmitted intelligence. The twenty-two stations were housed in three USAF mobile trailers. Eight stations were housed in each of two trailers and the remaining six were installed in a third trailer.

Two additional receiving stations were fabricated to provide facilities for pre-operational testing of the airborne equipment at sites located remotely from the trailer-housed receiving stations. These stations were very similar to those installed in the trailers, but were made portable for maximum operational convenience.

A fourth mobile trailer was modified to provide photographic dark-room facilities and work space at remote locations.

SECTION II

AIRBORNE TELEMETRY

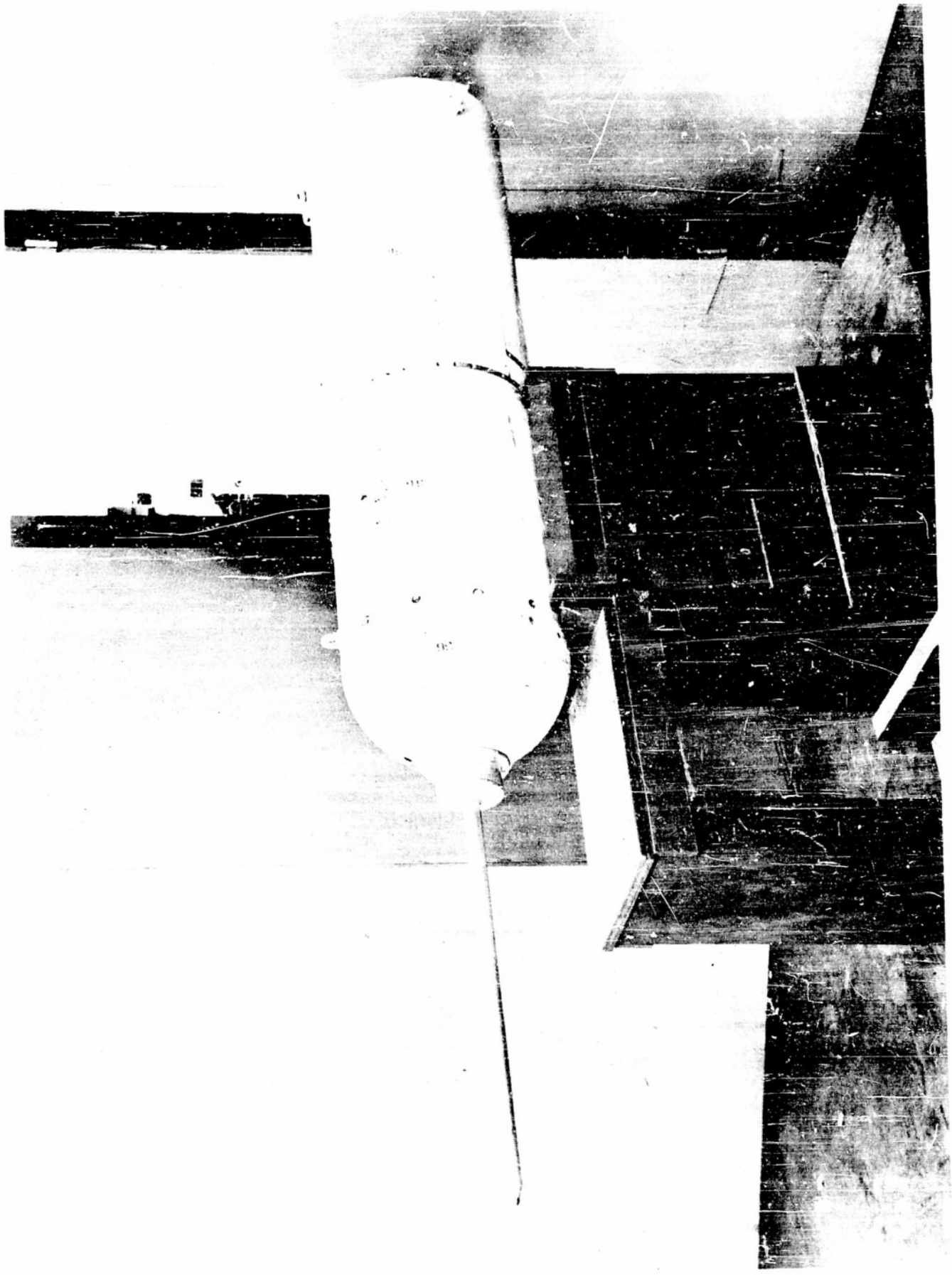
One hundred airborne telemetering canisters were designed and fabricated by Bendix Aviation Corporation, Pacific Division Development Laboratories under Contract No. AF 19(122)-459 with Air Force Cambridge Research Center. The canisters (see Figure 1) were designed to house a telemetering transmitting set plus an associated pressure measurement system, a Multiple Object Training System, a parachute suspension and control system, and power supplies. The canister weight minus instrumentation and power supplies is approximately two hundred pounds. The unit is very rugged, with the exception of the antenna and tail section, and will withstand severe shock without being damaged or deformed. In past usage, the canisters were deployed from B-29 aircraft, and a dual parachute system was employed to control their descent. Fifty of the canisters were expended in tests (on Contracts AF 19(122)-459 and AF 19 (604)-605) and three were expended for other purposes. Forty-seven of the one hundred canisters, although used, remainded in a serviceable condition at the termination of Contract No. AF 19(604)-605. The instrumentation of the canisters, checkout procedures, and test equipment data are covered in detail in Bendix Report No. DLM-4.

Physically the canisters consist of three sections: a nose section, center section, and tail section. The following table lists the approximate volume of each section.

Nose Section	450 cu. in.
Forward Compartment Center Section	680 cu. in.
After Compartment Center Section	1470 cu. in.
Forward Compartment Tail Section	570 cu. in.
After Compartment Tail Section	2070 cu. in.
Total . .	5240 cu. in.

The after compartment was designed to house the parachute package and consequently was not available for housing electronic equipment. Excluding this section, 3170 cu. in. of space is available in each canister to house instrumentation equipment. Thus it can readily be seen that a large amount of instrumentation could be packaged into the available space. For other applications the bulkhead which separates the center section into two compartments could be removed without sacrificing the structural integrity of the canister.

The canisters equipped with parachute suspension systems provide a unique means of obtaining measurements of free air phenomena. In the past approximately ninety percent of these deployed over land have been recovered undamaged except for the antenna. This presents the possibility of using these vehicles to obtain direct recordings of free air phenomena without the use of an RF link and the required ground equipment.



AIRBORNE TELEMETERING STATION

FIGURE 1

SECTION III

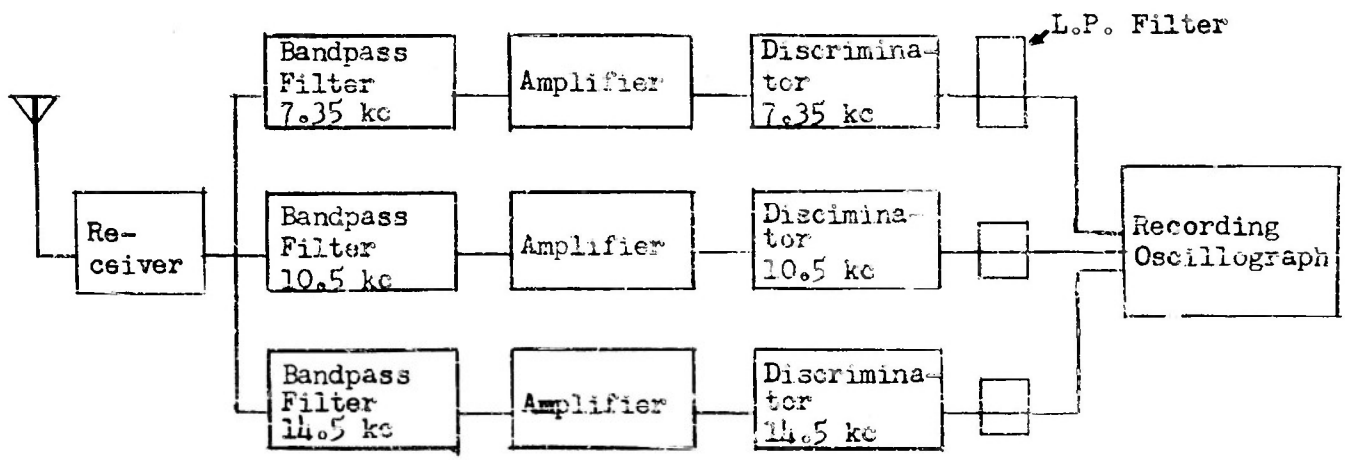
TRAILER RECEIVING STATIONS

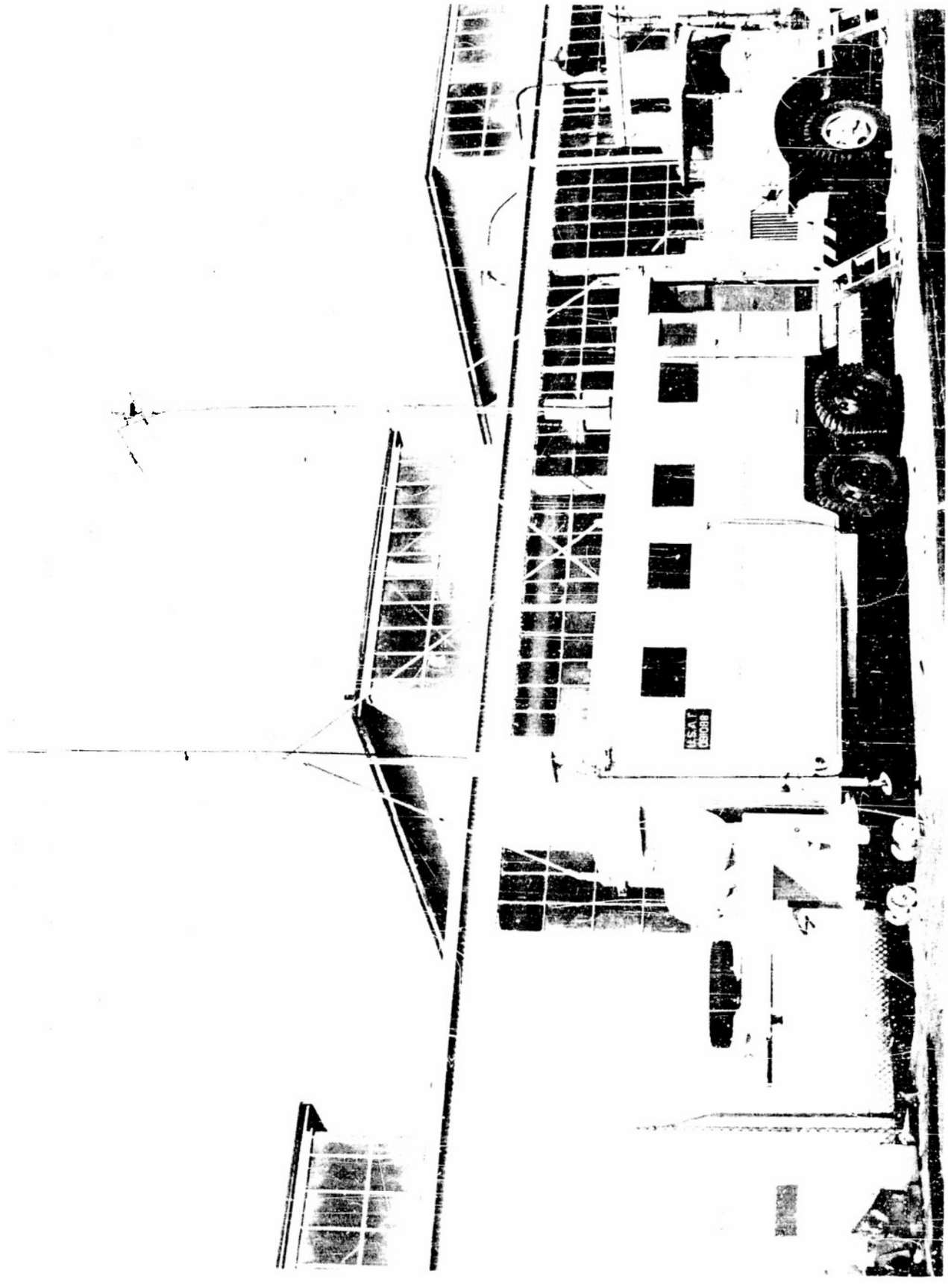
The twenty-two telemetering receiving stations are housed in three mobile trailers (see Figure 2). Two of the three trailers contain eight stations each and the third contains six stations. Figures 3 and 4 show two interior views of one of the eight station trailers. A fourth trailer is equipped with photographic dark room facilities and maintenance facilities. Bendix Instruction Book DLM-17 (AFSWP-221) provides complete operational and maintenance instructions for the trailers and the telemetering receiving equipment.

The telemetering receiving equipment installed in the three trailers can simultaneously receive and record data from twenty-two RF carriers each modulated by three subcarrier intelligence channels. As presently equipped, the three subcarrier channels in each station are 7.35 kc, 10.5 kc and 14.5 kc. Thus a trailer housing eight stations, contains twenty-four subcarrier discriminators, eight for each of the subcarrier frequencies listed above.

It is probable that for other uses it would be desirable to accommodate fewer RF carriers with an increased number of subcarrier channels per carrier. The telemetering receiving stations in the trailers could be converted to meet such requirements within limits at a relatively low cost.

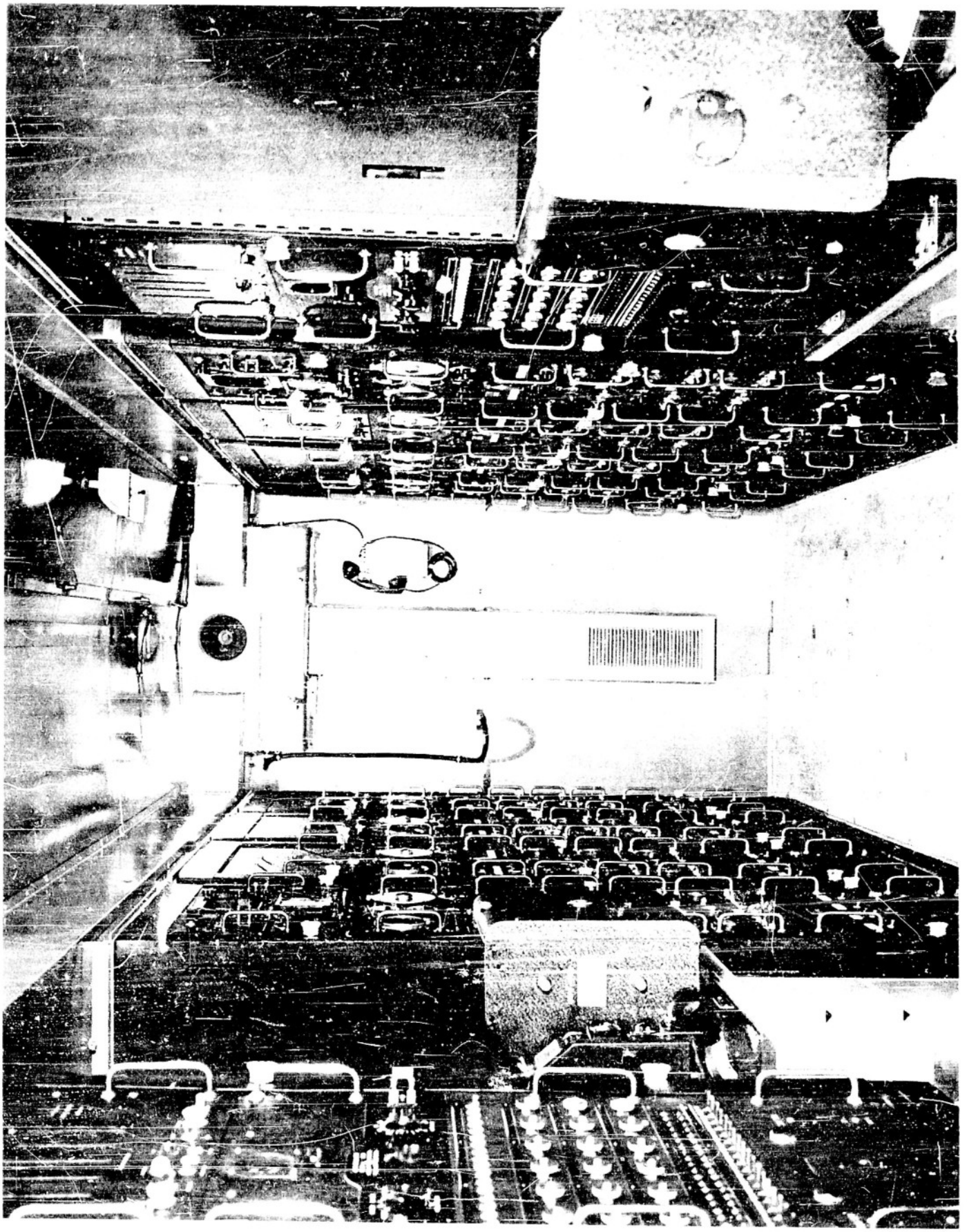
The basic telemetering station is illustrated by the block diagram below:





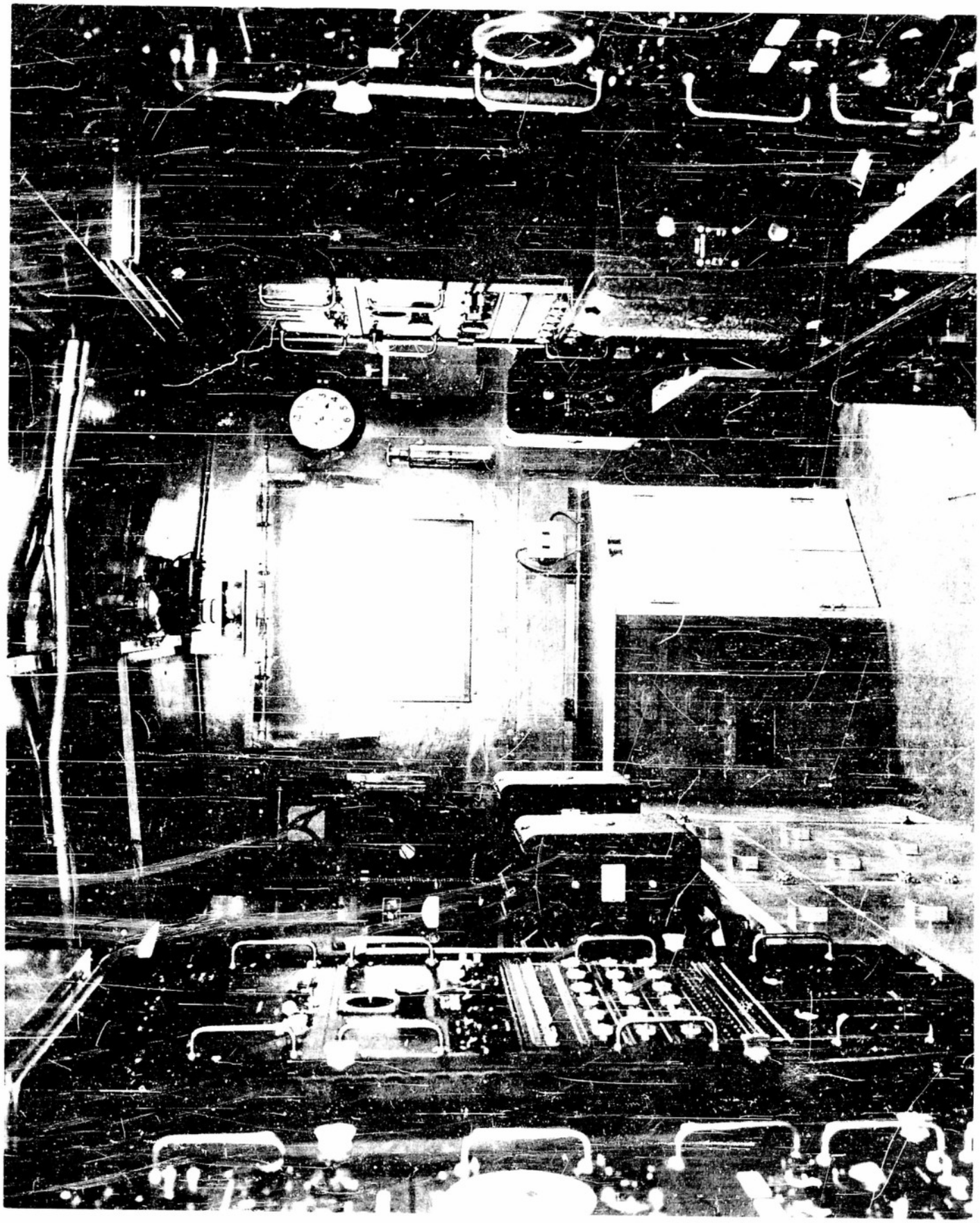
TELEMETRING TRAILER

FIGURE 2



INTERIOR VIEW, T/M TRAILER - LOOKING FORWARD

FIGURE 3

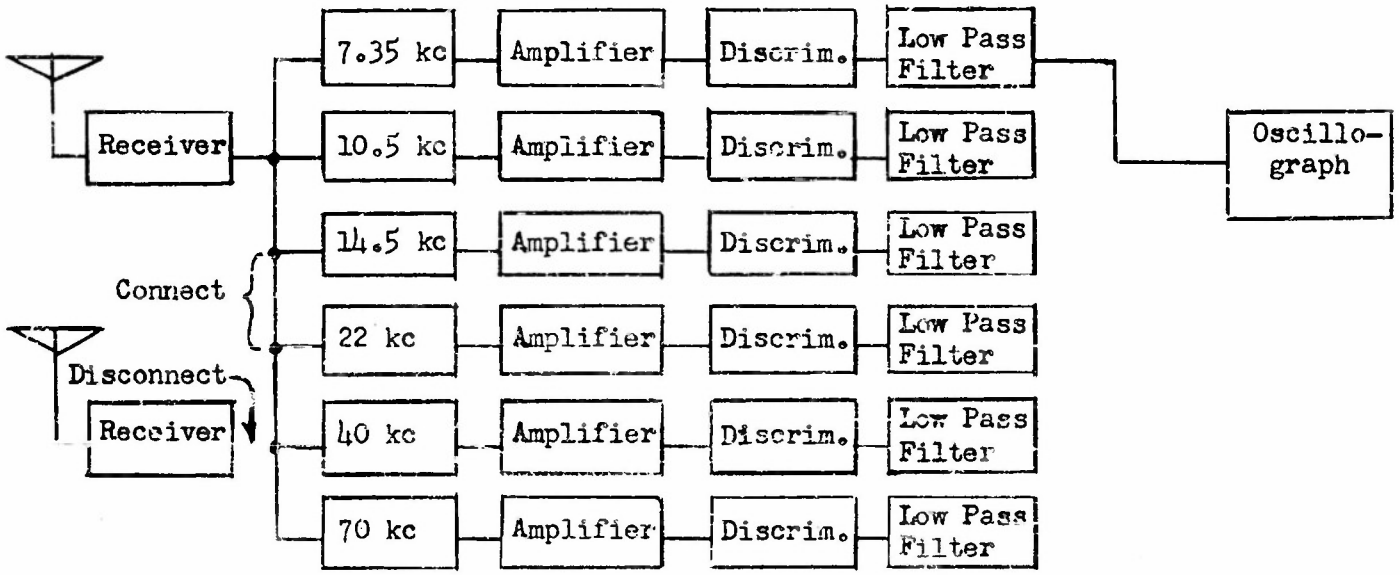


INTERIOR VIEW, F/M TRAILER - LOOKING AFT

Since the bandpass filters and low pass filters are standard plug-in units, and the discriminator frequency determining unit is also of the plug-in type, any three of the standard subcarrier channels listed below could be utilized by obtaining the desired plug-in components.

Center Frequency cps	Deviation % Center Frequency	Bandwidth cps	Intelligence cps
400	±7.5%	60	6
560	±7.5%	84	8
730	±7.5%	110	11
960	±7.5%	144	14
1300	±7.5%	196	20
1700	±7.5%	256	25
2300	±7.5%	346	35
3000	±7.5%	450	45
3900	±7.5%	586	60
5400	±7.5%	810	81
7350	±7.5%	1102	110
10500	±7.5%	1576	157
14500	±7.5%	2176	224
22000	±15 %	6600	660
40000	±15 %	12000	1200
70000	±15 %	21000	2100

By eliminating one receiver, and connecting its bandpass filters, etc., to another receiver, the number of subcarrier intelligence channels may be increased to six as shown below:



In the illustration above, the subcarrier frequencies of 22, 40 and 70 kc are merely arbitrary values, since any of the standard FM/FM subcarrier channels could be employed, as mentioned previously.

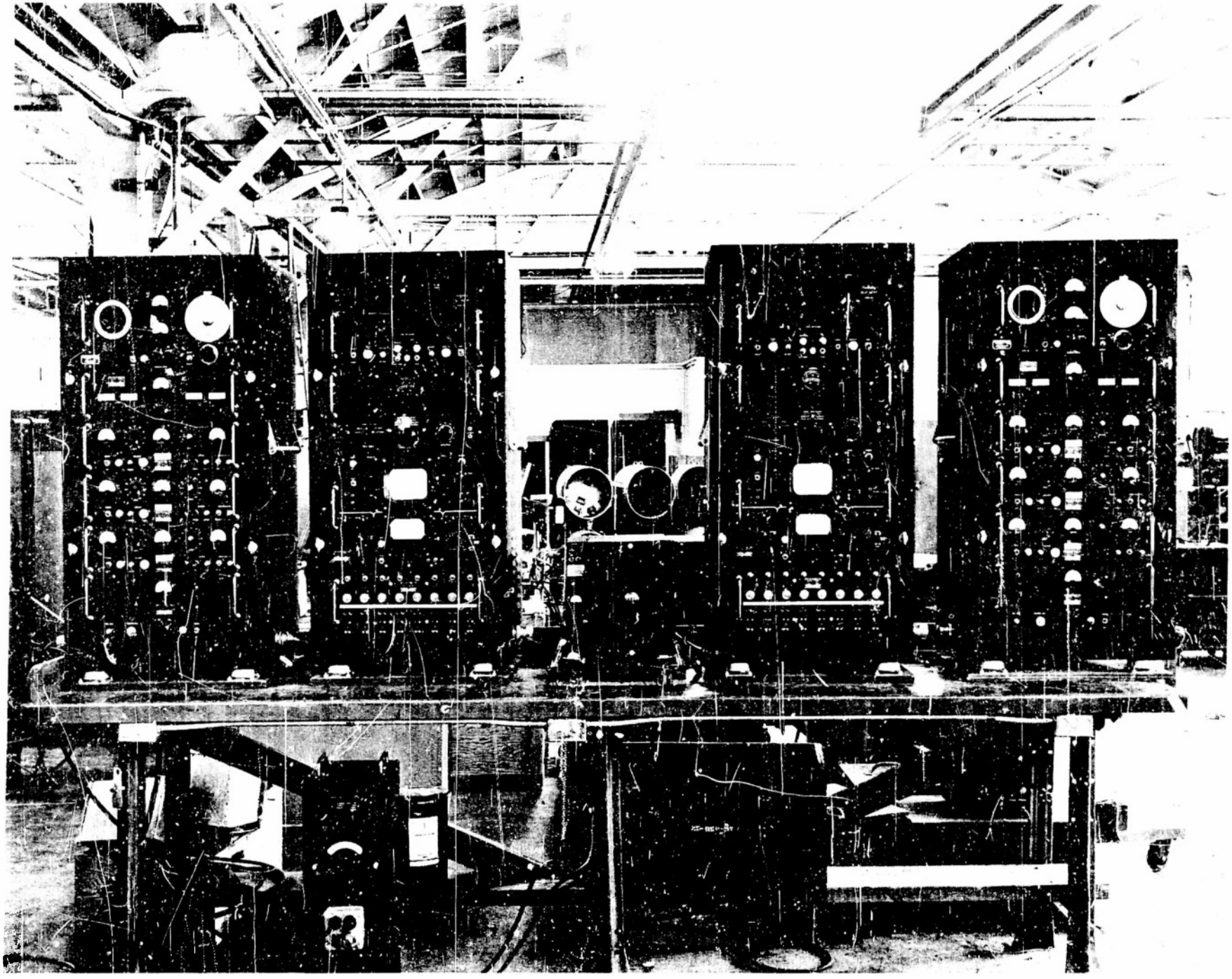
By similarly employing the subcarrier channels of other stations in the trailer the intelligence handling capacity of any one receiver can be increased to limits governed only by practical considerations. Maximum utilization of the available equipment in one of the eight-station trailers would result in two stations, each capable of receiving and recording twelve subcarrier intelligence channels. The arrangements described above would require modification of the existing inter-component wiring in the trailers. However, such wiring changes may be accomplished without great difficulty as all components are mounted in standard racks and are removable permitting easy access to the cabling which is installed in the rear of the racks.

Each trailer is equipped with two antenna masts and antennae. Each antenna may feed as many as four receivers through an antenna coupler connected between each antenna and its associated receivers. Provisions have been made for remotely training the antennae from inside the trailers. Each trailer is equipped with refrigerant type air conditioning. Other operational conveniences built into the trailers include an inter-trailer communications system, spare parts, storage space and equipment maintenance space.

SECTION IV

PORTABLE RECEIVING STATIONS

Bendix Report No. DIM-14 covers in detail the operating and maintenance instructions relating to the Portable Stations. The same flexibility is available in these stations as in the stations mounted in the trailers, with the exception that additional discriminators and mounting accommodations would be required for these units to handle additional subcarrier channels. These units were designed to be used for field checkout of airborne telemeters at sites remote from the trailer receiving station installations. Figure 5 shows the two portable receiving stations set up for operation.



PORTABLE RECEIVING STATION

DISTRIBUTION

Copy No.	
1 - 25	Commanding General Air Force Cambridge Research Center 230 Albany Street Cambridge 39, Massachusetts Attn: Chief, Research Division Marked for: Contract No. AF 19(122)-459 and No. AF 19(604)-605
26	H. D. Wilkinson
27	R. M. Combes
28	E. W. Copeland
29	R. E. Colander
30	C. C. Busenkell
31	L. A. G. ter Veen
32	C. L. Wetzel
33	C. J. Chini
34	C. W. Thomas
35 - 37	Publication File